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ABSTRACT

This study examined the effect of instruction in science process skills on teachers' achievement in reading, testing the hypothesis that teachers' reading comprehension can be improved significantly through the use of science process skills. Pre- and in-service teachers enrolled in competency based science methods courses formed the two groups for the study. Both groups were instructed in process skills using self-instructional programs, one on basic process skills and the other on integrated process skills. Pre- and post-testing of reading comprehension using the Nelson Denny Reading Test, Form A, revealed there were significant changes on the post-test scores for both groups after studying science process skills. (CS)

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THE EFFECTS OF INSTRUCTION IN SCIENCE PROCESS SKILLS ON READING COMPREHENSION OF PRE- AND IN-SERVICE ELEMENTARY TEACHERS

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THE EFFECTS OF INSTRUCTION IN SCIENCE PROCESS SKILLS ON READING COMPREHENSION OF PRE- AND IN-SERVICE ELEMENTARY TEACHERS*

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Research on reading comprehension has gained a great deal of attention in the last ten years. According to Hudgins and Read (1969), reading is one of the most complex learning tasks that children encounter in their educational experience. The focus on reading comprehension is a result of the contributions of theoretical linguistics and psycho-linguistic research. Such studies have generated theoretical concepts which appear to hold promise for a more definitive understanding of comprehension. Although various models have been proposed to account for the reading comprehension process (Kavanaugh and Mattingly, 1972), an analysis of these models have caused experts to conclude that there is no single model of the process (Gibson and Levin, 1975) given the many different kinds of reading a reader engages in.

A review of the literature reveals that the two most important skills needed for skillful comprehension are decoding words and the organization of words into meaning thought units. The next question then becomes, "What can be done to cause one to improve in these skills?". Researchers in science education have attempted to answer this question

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by testing the hypothesis that there is a relationship between Piagetian's tasks and reading comprehension. In one study, Almy, Crittenden, and Miller (1966) reported that there is a positive correlation among Piagetian's conservation tasks and the metropolitan reading readiness test. Research studies have also been reported that examined the effects of science curriculum project materials on reading comprehension. Riley and Westmeyer (1972) found that instruction in the Intermediate Science Curriculum Study (ISCS) caused an increase in students' reading comprehension scores. Similar findings have also been reported by Stafford and Renner (1971), Lawson, Nordland and Kahle (1975), Kellog (1971), and Coffia (1971).

Not only is reading a perennial problem at the elementary school level, but at the college level as well. For instance, from 1968 to 1972, research studies show that there was some improvement in reading rate gain, occasional vocabulary gains, and no loss of comprehension. Only one study, however, has been reported that examined the relationship of process skills instruction and reading at the college level. Porterfield (1974) reported that reading teachers who studied the Science Curriculum Improvement Study (SCIS) materials asked significantly more higher level questions, while teaching reading to their pupils, than reading teachers who were not instructed in the SCIS materials.

This study is an attempt to further the research efforts on process skills instruction and reading comprehension at the college level by examining the following hypothesis: Instruction in science process skills will cause a significant increase in pre- and in-service

teachers' reading comprehension scores. The independent variables in this study are basic and integrated science process skills and the dependent variable is reading comprehension.

METHODS

Subjects

The subjects (n = 44) for this investigation were in two intact groups. One group consisted of juniors and senior (n = 27) and the other graduate students (n = 17). Both groups were enrolled in competency-based science methods courses during the summer quarter (1976) at Florida International University. The undergraduate students met for four hours per week for five weeks, and the graduate students met for eight hours per week for five weeks. Subjects in the undergraduate class consisted of twenty five females and two males. Graduate subjects consisted of thirteen females and four males.

Procedures

On the first class meeting, all students were informed that they would be required to complete a series of exercises pertaining to science process skills and that they would be tested on these materials. They were also informed that a graduate student would come into the class and administer a test on reading comprehension for a project. It should be noted at this point that all students were informed that they were not required to complete the reading comprehension measure and that it would not count toward their final grade. During the second class meeting subjects completed the Nelson-Denny Reading Comprehension Test, Form A (pretest), and the pretests for the basic and integrated science process skills. Experimental treatment began during the third class meeting.

At this time, students were told to start work in the Basic Science Process Skills (BSPS) program (Okey and Campbell, 1973). The BSPS program is a self-instructional program and consists of six chapters on measurement, observation, classification, inference, and prediction. Each Chapter contains an introduction, objective, purpose and an estimate time required for completion. The instructional sequence consisted of some information, exemplary activities, practice exercises and feedback on each activity. At the end of each chapter self-tests and self-test answers were provided. This aspect of the experiment lasted approximately three class periods or an equivalent of five to six hours. Although the graduate and undergraduate students met for different time blocks, the amount of time they spent going through the program each week was approximately the same. At the next class meeting following the basic process instruction, all subjects completed the Basic Science Process Skills Achievement Test (BSPSAT). They were given two hours or one class period to complete this measure. During the next class meeting students began work on the Integrated Science Process Skills program (Okey and Fiel, 1972). This program consisted of ten chapters dealing with identifying variables, operationally defining variables, designing investigating, etc. The format for this program is the same as that described for the BSPS program above. Instruction on this program lasted eight hours or an equivalent of four class periods. On the next class meeting, all subjects completed the Integrated Science Process Skills Achievement Test (ISPSAI). Students were given two hours, or one class period, to complete this measure. The Nelson-Denny Comprehension Reading Test, Form A (posttest)

was administered on the next class meeting. Students were given twenty minutes to complete this measure. A description of the measure used in this investigation is found below. The reading comprehension measures were scored by two individuals unfamiliar with the materials or their purpose. The achievement tests were graded by a graduate assistant, with the name covered until all papers were scored.

MEASURES

Nelson-Denny Reading Comprehension, Form A (1960). This test consisted of thirty six items and was administered to all subjects participating in the study to measure reading comprehension. The total possible score for this measure was 72, with each correct response receiving two points. This is the same procedure described in the Nelson-Denny Examiner's Manual. According to the authors, validity was determined by using the item analysis and difficulty level techniques. Reliability was determined by using the equivalent-form method and found to be .81.

RESULTS

A repeated measures ANOVA of the results presented in Table 1 on the reading comprehension scores of the two groups indicated a non-significant group effect, a significant occasion effect, and a non-significant Group X Occasion interaction. These analyses mean that there were no significant differences on the reading comprehension test scores between the groups prior to the treatment, and that the groups were not differentially affected by the treatment. The results, however, indicated that there were significant increases for both groups on the reading comprehension post test scores, referred to in Table 1 as the occasion effect.

TABLE 1 - Repeated Measures Analysis of Variance on Reading Comprehension Scores (Graduate vs undergraduate)

Source	df	ss	MS	F
Groups	1	455.48	455.48	1.380
Subjects				
Within groups	42	13861	330.03	
Occasion	1	43343	43343	85.40*
Groups X				
Occasion	1	742.09	742.09	1.462
Subjects				
Within Groups X				
Occasion	42	21317	507.55	

*P $<$ .001

CONCLUSIONS AND IMPLICATIONS

Although it has been shown that some progress has been made toward understanding the reading comprehension process, it is doubtful that a single reading model is forthcoming. In this study, however, it has been shown that process skills instruction can cause an increase in teachers' reading comprehension. This result supports studies reported by Riley and Westmeyer (1972); Stafford and Kenner (1971); and Lawson, Nordlen and Kahle (1975).

The data revealed no significant differences between the pre- and in-service teachers' reading comprehension on the pretest and posttest scores. It was speculated that the in-service teachers, due to their experiences, would have obtained significantly higher reading comprehension scores than the pre-service teachers. From this finding, it can be concluded that although in-service teachers have completed teacher training programs, their ability to comprehend is significantly no better than pre-service teachers. This would also cause one to speculate on their knowledge of, and use of, science process skills with their students. The implications of this study are clear. Reading Comprehension, it appears, for both the undergraduate and graduate teachers can be enhanced through the use of process skills. Further, it can be hypothesized that teachers increased reading comprehension will result in their ability to interpret, and implement effective learning skills with their pupils. A major portion of graduate and undergraduate methods courses should, therefore, be centered around science process skills.

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